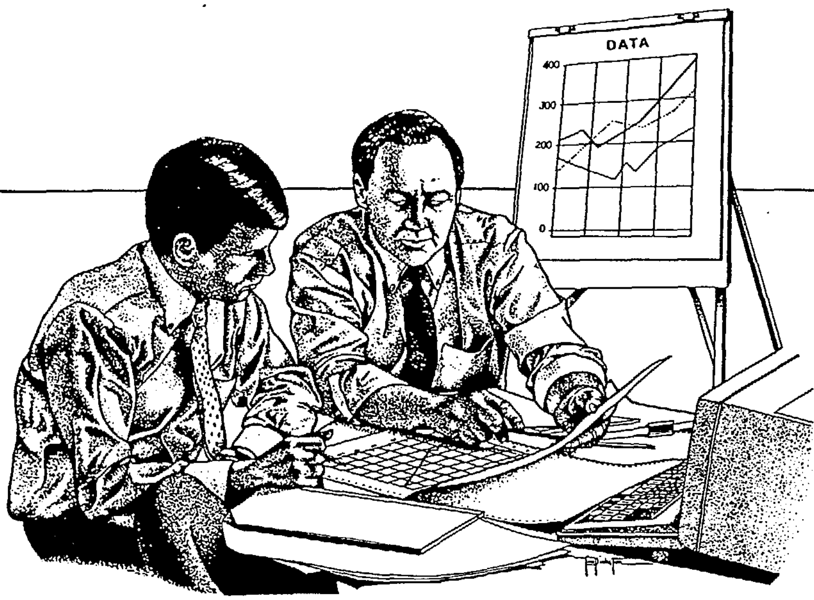
Chapter Three
CAPACITY ANALYSIS AND FACILITY REQUIREMENTS



Chapter Three
CAPACITY ANALYSIS AND FACILITY REQUIREMENTS

Forecasts of future unconstrained aviation demand for Mesa-Falcon Field were presented in Chapter Two. These forecasts included aircraft operations, based aircraft, peaking characteristics, and aircraft fleet mix. With this information, the capability of specific components of the airport system were evaluated to determine if they are adequate to accommodate the forecast aviation demands without causing significant operational delays or deterioration of service levels.

Two fundamental planning procedures are utilized in the facility requirements analysis: the demand capacity analysis and the determination of airport development needs. The objective of this effort is to identify deficiencies in existing airport facilities and outline which new facilities will be needed to accommodate forecast demands. Once deficiencies in the airport facilities are identified, a more specific determination of the approximate sizing and timing of new facilities is made.

AIRFIELD CAPACITY

An airfield capacity analysis for Mesa-Falcon Field was used to determine the existing capacity of the runway system and to identify any present or potential deficiencies. This was accomplished by first determining the capacity of the existing runway and comparing this capacity to the forecast levels of aviation activity.

The methodology used in analyzing airfield capacity is contained in **Airport Capacity and Delay**, FAA Advisory Circular 150/5060-5. This methodology utilizes a combination of variables which provides a more realistic picture of both the ground and air constraints being experienced at U.S. airports than was provided by previous methodologies. The analysis measures the capacity of the airfield in three primary areas: hourly capacity of runways; annual service volume of the runway system; and aircraft delay during peak hour conditions.

Hourly Capacity: A basic measure of capacity that can be related to peak hour activity. Hourly capacity of runways is defined as the maximum number of aircraft operations that can take place in one hour. This measure will be influenced by exit taxiway locations, weather conditions, and the level of touch-and-go activity.

Annual Service Volume: A level of aircraft operational capacity that may be used as a reference in planning the runway system. In general, as annual aircraft operations increase and approach annual service volume, the average delay to aircraft throughout the year increases.

Annual Aircraft Delay: The total delay in hours incurred by all aircraft operating at the airfield in one year.

Hourly runway capacity, annual service volume, and aircraft delay are all interrelated and highly dependent on a number of capacity factors. The specific factors considered in this capacity analysis included:

- Meteorological Conditions - Weather conditions as they affect runway utilization, orientation and aircraft separation requirements.
- Runway Use - The percentage of time which each runway is in use.
- Aircraft Mix - The percentage utilization of the airfield by each aircraft class.
- Percent Arrivals - The percentage of total arrivals to departures during peak hours.
- Percent Touch-and-Go - The percentage of total aircraft operations that are touch-and-go training operations.
- Exit Taxiway Locations - The locations of exit taxiways for landing aircraft.

METEOROLOGICAL CONDITIONS

Weather conditions at an airport have a significant effect on the utilization of the runways and, consequently, affect the capacity of the runway system. Runway utilization at the airport is dictated by wind conditions, cloud ceiling, and visibility. The direction of takeoffs and landings is generally determined by the prevailing winds.

As weather conditions deteriorate, the capacity of a runway will decrease as well, until weather conditions become so poor that aircraft cannot attempt a takeoff or landing. There are various types of instrument approach systems available which increase the ability of an airport to remain operational during deteriorating weather conditions. These instrument approach systems and approach procedures are also considered in the analysis of runway capacity.

Three types of weather conditions are categorized for every airport. Visual Flight Rule (VFR) conditions exist when cloud ceilings are in excess of 1,000 feet above the airport and a runway visibility is more than three miles. Whenever the weather is reduced to conditions below 1,000-foot ceilings and/or three miles visibility, Instrument Flight Rule (IFR) conditions are said to exist. Poor Visibility and Ceiling (PVC) conditions are said to exist if the weather deteriorates to ceilings of less than 500 feet and/or visibility is less than one mile.

During the year IFR conditions occur less than two percent of the time in the Phoenix area. Whenever IFR conditions are two percent or less, the effect on capacity can be ignored and calculations of airfield capacity based on VFR conditions.

RUNWAY USE

Runway use is expressed in terms of the number, location, and orientation of active runways. It involves directions and kinds of operations using each runway. To maximize capacity at Mesa-Falcon Field, landings and takeoffs can be conducted on both runways at the same time. Runway 4 is used approximately 60 percent of the time while Runway 22 is used approximately 40 percent of the time. Approximately half of the airport's operations are conducted on each runway. Jet, turboprop aircraft and non-MDHC helicopters operate primarily to Runway 4R-22L. Approximately 75 percent of the airport's traffic turn to the north after takeoff.

AIRCRAFT MIX

Airport capacity is also dependent on the types of aircraft forecast to use the facility. Aircraft approach speed and landing distance both affect runway occupancy times. The longer aircraft remain on the runway the less capacity the airport has to accommodate arriving and departing aircraft. Therefore, aircraft mix is a major factor in the procedure to calculate airport capacity.

The airside capacity methodology identifies four classes into which aircraft are categorized. Classes A and B include small propeller aircraft and business jets weighing 12,500 pounds or less that are typical of general aviation. Classes C and D consist of large jet and propeller aircraft generally associated with airline and military use. **Exhibit 3A** illustrates examples of aircraft in each class. Based upon the forecasts of demand presented in the previous chapter, the aircraft operational mix for Mesa-Falcon Field are presented in **Table 3A**.

The **Airport Capacity and Delay** advisory circular assumes an ILS instrument approach navaid, a radar controlled environment and unrestricted runway use in designing the hourly capacity graphs used to determine the runway hourly capacity. The absence of any of these, or all three, will normally reduce the hourly capacity of a runway, especially under adverse weather conditions. In an analysis of these factors at Falcon Field when compared with the airport's mix index, it was determined that the hourly capacity difference was negligible.

TABLE 3A
Aircraft Operational Mix
Mesa-Falcon Field

	Percentage				
Year	Class A	Class B	Class C	Class D	Mix Index
Existing (1990)	89%	10%	1%	0%	1
Forecast					
1995	88%	11%	1%	0%	1
2000	85%	13%	2%	0%	2
2005	83%	14%	3%	0%	3
2010	82%	15%	3%	0%	3
2015	80%	16%	4%	0%	4

PERCENT ARRIVALS

The percentage of all aircraft operations that are arrivals has an important influence on the hourly capacity. For example, a runway used exclusively for arrivals will have a lower capacity than a runway used exclusively for departures. The hourly capacity of a runway is generally lower the higher the percentage of arrivals. At Mesa-Falcon Field, arrivals were determined to be 50 percent of the peak hour operations.

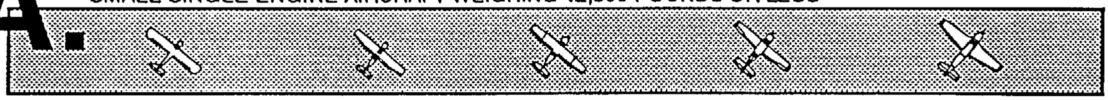
91MP04-3A-8/21/91

AIRCRAFT CLASSIFICATIONS

AIRCRAFT CLASSIFICATION

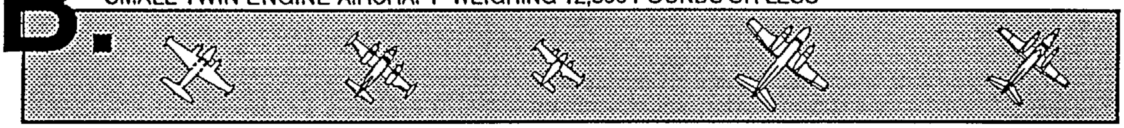
REPRESENTATIVE TYPES OF AIRCRAFT DESCRIPTION

A. SMALL SINGLE ENGINE AIRCRAFT WEIGHING 12,500 POUNDS OR LESS



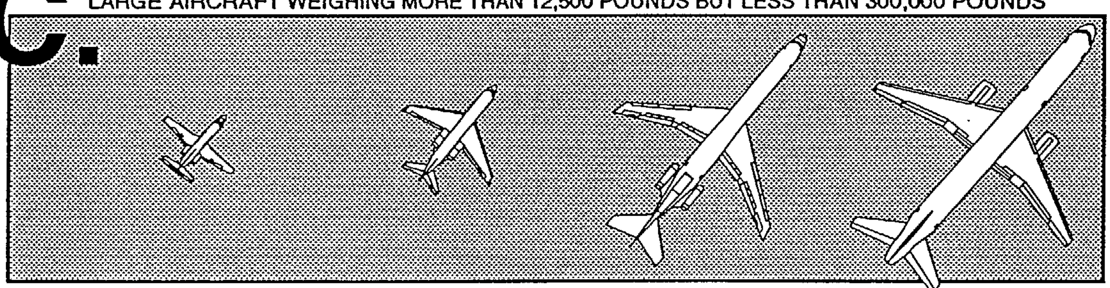
PA-18 C-150 C-180 C-210 BONANZA

B. SMALL TWIN ENGINE AIRCRAFT WEIGHING 12,500 POUNDS OR LESS



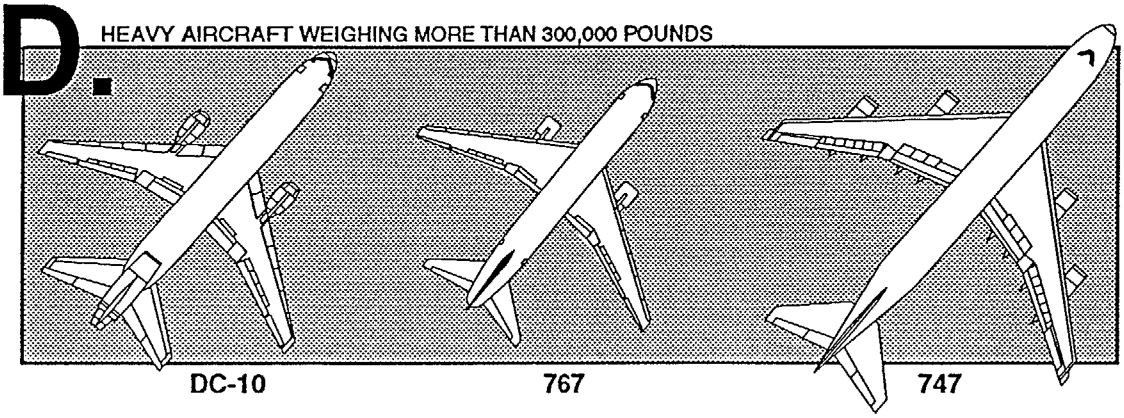
PA-31 C-402 C-310 KING AIR BEECHCRAFT 99

C. LARGE AIRCRAFT WEIGHING MORE THAN 12,500 POUNDS BUT LESS THAN 300,000 POUNDS



CITATION V GULFSTREAM IV 727 757

D. HEAVY AIRCRAFT WEIGHING MORE THAN 300,000 POUNDS



DC-10 767 747

1. WEIGHTS REFER TO MAXIMUM CERTIFIED TAKE OFF WEIGHT.
2. HEAVY AIRCRAFT ARE CAPABLE OF TAKE OFF WEIGHTS OF 300,000 POUNDS OR MORE WETHER OR NOT THEY OPERATE AT THIS WEIGHT.

MESA-FALCON FIELD

Exhibit 3A
AIRCRAFT CLASSIFICATIONS

PERCENT TOUCH-AND-GOS

A touch-and-go operation refers to an aircraft which lands and then immediately takes off without coming to a full stop. Touch-and-go activity is counted as two operations since both an arrival and a departure are conducted. Touch-and-gos can be a significant component of an airport's total operations and affect the capacity of the airfield since runway occupancy times are minimized for this type of operation. At Mesa-Falcon Field Airport, touch-and-go activity is relatively high due to the extensive fixed wing training and helicopter activity. In calculating the capacity of the runway system, it is necessary to remove helicopter operations from the touch-and-go percentage. The adjusted touch-and-go percentage for the airport is calculated to rise from 45 percent of operations in 1990 to a peak of 50 percent of operations in 2005 before declining to 46 percent by the end of the planning period as transient activity increases.

EXIT TAXIWAY LOCATIONS

The most notable characteristics considered in the airside capacity model, outside of the runway configuration, are the number and types of taxiways available to exit the runway. The location of exit taxiways affects the runway occupancy time of an aircraft. The longer an aircraft remains on the runway, the lower the capacity.

The runways at Mesa-Falcon Field do not have a sufficient number of properly located exit taxiways to obtain the highest taxiway exit factor. Runway 4L-22R, which is 3,800 feet in length has only one exit taxiway. Runway 4R-22L is 5,150 feet long and has three taxiways that qualify as exit taxiways. Runway capacity can be increased by providing additional exit taxiways on Runway 4L-22R to obtain a higher taxiway exit rating.

CAPACITY ANALYSIS

The preceding information was used in conjunction with the airside capacity methodology to determine the airfield capacity at Mesa-Falcon Field. Three separate results were obtained from the analysis.

- Hourly Capacity of Runway
- Annual Service Volume
- Annual Aircraft Delay

From these results it is possible to determine the adequacy of the current airfield to accommodate potential demand scenarios and to determine the range of aircraft delay associated with each demand level.

Runway Capacity

The first step of the analysis involved the computation of an hourly runway capacity for each potential runway use configuration. The percentage of use then becomes an important factor in determining the weighted hourly capacity of the airfield.

Based upon the existing runway system and taxiway exit rating, an aircraft mix of one percent Class C (Cessna Citation, for example) and 45 percent touch-and-go operations, the existing weighted hourly capacity was determined to be approximately 256 operations during the peak month.

In the future, the percentage of Class C aircraft will grow to approximately four to five percent. The percentage of touch-and-go activity is also expected to be approximately 46 percent. This will result in the weighted hourly capacity decreasing to 247 operations. The weighted hourly capacities are compared to forecast design hour service volumes in **Table 3B**.

Annual Service Volume

Once the weighted hourly capacity is known, the Annual Service Volume (ASV) can be determined. Annual Service Volume is calculated by the following equation:

$$ASV = C \times D \times H$$

C = weighted hourly capacity
D = ratio of annual demand to average daily demand during the peak month
H = ratio of average daily demand to average peak hour demand during the peak month

As mentioned earlier, the weighted hourly capacity is currently 256 operations. In the future, a heavier aircraft mix will reduce this capacity to 247 operations. In order to more accurately affect the current limitations in the airport's traffic pattern (all traffic must operate to the north of the landing runways) an adjustment was made to the hourly capacity. The current Annual Service Volume (ASV) for Mesa-Falcon Field was determined to be approximately 443,000 operations.

As annual activity increases and aircraft delays become greater, the annual service volume will normally decrease. By the end of the planning period the existing runway system will have an annual service volume of 433,800 operations. It is evident from **Table 3B** that Mesa-Falcon Field will not exceed runway capacity before the end of the planning period.

TABLE 3B
Airfield Capacity/Delay Summary
Mesa-Falcon Field

	Annual Operations	Design Hour Operations	Annual Service Volume	Weighted Hourly Capacity	Avg. Delay/ Operation (minutes)	Total Annual (hours)
Existing(1990)	203,685	118	443,000	256	0.27	1,528
1995	294,400	141	438,300	255	0.68	3,312
2000	304,800	143	434,900	252	0.68	3,429
2005	317,200	146	429,300	248	0.70	3,701
2015	349,600	152	433,800	247	0.80	4,661

Annual Delay

Even before an airport reaches capacity, it begins to experience certain amounts of delay to aircraft operations. Delays occur to arrival traffic that must wait in the traffic pattern or on an IFR holding pattern awaiting their turn to land. Departing traffic must hold on the taxiway or the holding apron while waiting for the runway and final approach to be cleared. As the operations at an airport grows toward capacity, aircraft delays increase exponentially.

Annual delay is currently estimated at 1,528 hours at Falcon Field. By the year 2015, this should increase to a total of 4,661 hours. This amount of delay, less than one minute per operation is not considered significant. **Table 3B** compares the delay at each period in the airport's development. The existing level of delay is relatively low and is considered acceptable.

Generally FAA recommends consideration of development of improvements for capacity when annual aircraft operations reach 60 percent of Annual Service Volume. By the end of the planning period, operations at Mesa-Falcon Field are forecast to be at 80 percent of Annual Service Volume.

AIRSIDE FACILITY REQUIREMENTS

Airside facility requirements include those facilities directly related to the arrival and departure of aircraft:

- Runways
- Taxiways
- Airfield Instrumentation and Lighting

The selection of the appropriate FAA design standard for the development of airfield facilities is based primarily upon the characteristics of the most demanding aircraft expected to use the airport. The most critical characteristics are the approach speed and the wingspan of the critical aircraft anticipated to use the airport both today and in the future. The planning for future aircraft use is particularly important because design standards are used to plan separation distances between facilities that could be extremely costly to relocate at a later date.

According to FAA Advisory Circular 150/5300-13, **Airport Design Guide**, aircraft are grouped into five categories based upon their certified approach speed. These categories range from Category A for slower single engine piston aircraft, to Category E for supersonic jet aircraft. The predominant aircraft using Mesa-Falcon Field today, fall into Categories A and B (approach speeds less than 121 knots).

The same advisory circular also defines six Airplane Design Groups (ADGs) according to the physical size of the aircraft. The airplane's wingspan is the principal characteristic affecting design standards. Airplane Design Groups range from Group I for small aircraft with wingspans less than 49 feet to Group VI for the largest cargo aircraft. The majority of aircraft using Mesa-Falcon Field fit into Group's I and II (wingspans less than 79 feet).

Historically, general aviation airports are divided into two major design classifications -- Utility and Transport. A Utility Airport is an airport designed, constructed and maintained to serve airplanes in Aircraft Approach Category A and B. Transport Airports are designed, constructed, and maintained to serve airplanes in Aircraft Categories C and D. Each of these classifications are further subdivided by design aircraft size, weight, and speed.

- BASIC UTILITY - This type of airport accommodates small, single engine and small twin-engine airplanes, less than 12,500 pounds gross weight, used for personal and business purposes. The length of the runway will determine how many types of these aircraft will be able to operate at the airport. Aircraft that will use this class of airport will typically have wingspans less than 49 feet and approach speeds of less than 121 knots. Precision instrument approach systems are usually not planned for airports in this category.

- GENERAL UTILITY - This type of airport accommodates all small airplanes and some larger aircraft weighing more than 12,500 pounds with wingspans up to 79 feet and approach speeds of less than 121 knots. Precision instrument approach systems may be installed at airports in this category.

- TRANSPORT - This type of airport is designed for larger aircraft with higher approach airspeeds up to 166 knots. Typical wingspans vary from less than 49 feet up to 262 feet. Precision instrument approach operations are normally planned for most Transport airports.

Mesa-Falcon Field is classified by the FAA in its National Plan of Integrated Airport Systems (NPIAS) as a General Utility Airport with future development as a Transport Airport. This design classification (transport, utility, etc,) is currently being replaced by an Airport Reference Code (ARC) system that describes the airport in terms of ADG and approach speeds. In the case of Mesa-Falcon Field, the forecast activity at the airport and the growth of the region could be accommodated with the present ARC B-II. However, the ability to accommodate larger corporate jet aircraft would require a longer runway and might also require a change to ARC C-II or B-III. These particular design groups will be analyzed in the next chapter.

Airport design specifications are more specifically determined by analyzing the aircraft mix and determining the most demanding airplane(s) to be accommodated. Although one aircraft may determine runway length, another may define runway pavement strength or other appropriate design parameter. The following paragraphs detail the criteria used to establish airfield dimensions, capabilities, and requirements.

RUNWAYS

The adequacy of the existing runway system was analyzed from a number of perspectives including airfield capacity, runway orientation, runway length, and pavement strength. From the prevailing local conditions and the forecast of aviation activity, the requirements for runway improvements were determined for Mesa-Falcon Field .

Runway Length

The ultimate runway length will determine the types of aircraft that will be able to operate at Falcon Field. Runway length requirements are based upon four primary factors:

- The types of aircraft expected to use the runway.
- The mean maximum daily temperature of the hottest month.
- The airport elevation.
- The effective runway gradient.

At Falcon Field, the mean maximum daily temperature of the hottest month (July) is 105 degrees Fahrenheit. The airport elevation is 1,392 feet above mean sea level (MSL). Runway 4R-22L has an effective runway gradient of 0.05 percent to the northeast.

Given the above conditions of climate and topography, runway lengths can be calculated for various types and groupings of aircraft. The existing runway length of 5,150 feet for Runway 4R-22L exceeds the standard runway length for 100 percent of small aircraft (those that weigh less than 12,500 pounds) that are capable of carrying 10 or less passengers. However, it does not provide sufficient length to accommodate many business jet aircraft except under very favorable conditions. The standard runway lengths for the various categories of runways are shown in **Table 3C**.

Runway length requirements for B-II runways are not only determined by the previously mentioned climatological factors, but are also based on the percentage of the business jet fleet the runway is expected to accommodate. The fleet percentage values are based on groupings of the business jet aircraft fleet weighing less than 60,000 pounds. Additionally, the loading conditions (the percentage of useful load) under which these aircraft are expected to operate greatly influences the amount of runway required to operate safely from the airport. **Table 3C** also illustrates the standard runway length requirements for Mesa-Falcon Field in order to accommodate various segments of the business jet fleet under standard loading conditions.

TABLE 3C
Runway Length Requirements
Mesa-Falcon Field

Gross Wt: <12,500 lbs	Runway Length
Small Aircraft, less than 10 seats	4,400 ft.
Small Aircraft, more than 10 seats	4,800 ft.

Gross Wt: <60,000 lbs

Percent of Business Jet Fleet	Percent of Useful Load	Runway Length
75	60	5,500 ft.
75	90	8,300 ft.
100	60	7,200 ft.
100	90	11,300 ft.

Comparing the runway length requirements for the general aviation fleet, it was determined that a runway length of 5,500-8,300 feet should be investigated to accommodate the widest possible range of general aviation aircraft with the existing environmental limitations and demands. The 8,300 foot runway would accommodate 75 percent of the general aviation turbojet fleet operating anywhere between 60 and 90 percent useful load.

Runway Width

Runway width requirements are based on ARC B or C-II criteria which require a minimum runway width of 75 feet. A runway width of 100 feet will accommodate a precision instrument approach to the runway for an airport in ARC B or C-II. However, a 100 foot width also provides improved crosswind coverage and increases the safety factor at the airport during high velocity crosswind conditions.

Runway Pavement Strength

Runway 4R-22L currently has a rated pavement strength of 40,000 pounds single wheel loading (SWL). Runway 4L-22R has a rated pavement strength of 12,500 pounds SWL. A pavement strength and condition analysis is presently being conducted at the airport. The results of this analysis will be used to determine the future pavement improvement programs for the airport.

The existing pavement strength ratings will meet the forecast demand throughout the planning period. In the event an aircraft larger than forecast performs 500 or more operations annually, a pavement analysis should be conducted to determine if the pavement strength is adequate. Normal pavement overlays to preserve the existing pavement surface performed during the planning period, will improve the pavement strength.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movement between the runway system and the terminal area. Some taxiways are necessary simply to provide access between the parking apron and runways, whereas others become necessary as activity increases to prevent traffic congestion and provide more efficient use of the airfield.

Each runway has a full length parallel taxiway situated so as to minimize taxiway distances and runway crossings. Taxiways also provide the most direct route from the terminal area to the runway in use. In addition, there should also be a sufficient number of exit taxiways to minimize runway occupancy times. These exit taxiways should be strategically located along the runway for the types of aircraft expected to use the runway. Taxiways that will serve ADG II aircraft should be a minimum of 35 feet wide.

Taxiways should be designed to have the same pavement strengths of the runway they serve. If the taxiway is to be utilized primarily by business jets, an ultimate 30,000 pound SW pavement strength will be necessary. Taxiways designed to serve only small general aviation aircraft (ADG I) can be reduced to 25 feet in width. Taxiways used exclusively by small aircraft should have a minimum pavement strength of 12,500 pounds SW.

One of the potential problem areas on the airport is Taxiway B-6 and B-7, taxiway/taxilanes that cross Falcon Drive to provide access into the hangar area south of Falcon drive. Potential solutions to provide safe access to aircraft and transit for vehicles will be addressed in the next chapter.

AIRFIELD INSTRUMENTATION AND LIGHTING

Navigation aids provide two primary services to airport operation's: precision guidance to a specific runway and/or nonprecision guidance to a runway or the airport itself. The basic difference between a precision and nonprecision navigational aid is that the former provides electronic descent, alignment (course), and position information while the latter type provides only alignment and position information. The necessity of such equipment is usually determined by design standards predicated on safety considerations and operational needs. The type, purpose and volume of aviation activity expected at the airport are factors in the determination of the airport's eligibility for navigational aids.

Airport and runway navigational aid (navaids) requirements are based upon FAA recommendations as depicted in **Airway Planning Standards Number One**, DOT/FAA Handbook 7031.2B, and **Airport Design Standards, Site Requirements for Terminal Navigational Facilities** FAA Advisory Circular 150/5300-2D.

The Scottsdale Nondirectional Radio Beacon (NDB), located 13.7 nautical miles northwest of the airport, provides both enroute and terminal navigation to Mesa-Falcon Field. The NDB is used for a nonprecision instrument approach to the airport, circling to land at any runway. There is no precision instrument approach capability to Mesa-Falcon Field.

The FAA has plans to relocate the Rio Salado NDB and install it at Mesa-Falcon Field. Although an instrument procedure has not been planned for this facility, it appears likely that a nonprecision approach with straight-in approach capability to either runway could be designed for the airport. Recommendations for any additional approaches will be dependent upon the analysis of future development alternatives and the final airport development concept.

Glide path indicator lights are a system of lights which provide visual descent guidance information during an approach to the runway. Currently all runways are equipped with Precision Approach Path Indicators (PAPI). Runway End Identifier Lights (REIL) are installed to provide rapid and positive identification of the approach end (threshold) of a runway. Runway 4R-22L is equipped with REIL's. REIL's should be installed on Runway 4L-22R at some point during the planning period.

The existing runway and taxiway lighting systems at Mesa-Falcon Field are Medium Intensity Runway Edge Lighting (MIRL) on both runways and Medium Intensity Taxiway Lights on most of the taxiways and taxilanes. MITL should be considered for all remaining unlighted taxiways and major taxilanes.

Installation of reflective edge markers along all sections of unlighted pavement is recommended as a low cost interim measure prior to installation of edge lights. These reflective markers will improve the safety of nighttime aircraft movements on the airport and help eliminate inadvertent taxiing off of paved surfaces.

LANDSIDE FACILITY REQUIREMENTS

Components of the general aviation landside complex include the following types of facilities:

- Hangars
- Parking Apron
- Terminal Building
- Automobile Parking
- Fuel Storage

The capacities of the various components are examined in relation to projected demand to identify future landside facility needs.

HANGARS

The demand for hangar facilities is dependent upon the number and types of aircraft expected to be based at the airport. Actual percentages of based aircraft desiring hangar facilities will vary across the country as a function of local climatic conditions, airport security, and owner preferences. This percentage will also vary with value and sophistication of the aircraft, and will typically range anywhere from 30 to 80 percent.

Hangar facilities are generally classified as conventional hangars, T-hangars, or shades (covered tiedowns). These different types of hangar facilities offer varying degrees of privacy, security, and protection from the elements. All of the existing T-hangar facilities at Mesa-Falcon Field are currently occupied and the airport has a waiting list for approximately 108 aircraft T-hangars. If the existing T-Hangar demand were met, approximately 65 percent of the aircraft would be stored in T-hangars.

The majority of the hangared aircraft, 68 percent, are in conventional (10 percent) or T-Hangars (58 percent) while the remainder are in shade hangars (18 percent) or on tiedowns (14 percent). Although the intense summer weather conditions places a significant premium on sheltered parking, T-hangars are more in demand than shade hangars.

For planning purposes, it was assumed that 85 percent of the single, 90 percent of the twin engine aircraft, and 100 percent of the helicopters and turbine powered aircraft would desire hangar storage. In addition, it was assumed that 70 percent of the individual aircraft storage requirements would be met with T-hangars with the remaining aircraft divided equally between conventional, and shade hangar storage.

A planning standard of 1,250 square feet (SF) was used for T-hangar storage. Space requirements for conventional hangar space were based on 1,000 SF per piston and rotary wing aircraft, 2,000 SF per turboprop aircraft and 2,500 SF for jet aircraft. In addition, service or maintenance hangar space was estimated at 15 percent of the total hangar storage area. This maintenance hangar area will be in addition to the individual hangar facilities.

Table 3D outlines the projected hangar requirements throughout the planning period.

TABLE 3D
Forecast Hangar and Hangar Apron Requirements
Mesa-Falcon Field

	Existing	Forecast			
	1990	1995	2000	2005	2015
BASED AIRCRAFT					
Single Engine	597	663	667	684	739
Twin Engine	32	49	59	75	87
Turboprop	2	5	8	9	15
Turbojet	0	1	2	3	5
Rotorcraft	12	18	20	22	28
Total	**643**	**736**	**762**	**793**	**874**
NUMBER OF AIRCRAFT HANGARED	558	632	655	683	754
CONV HANGAR POSITIONS					
Single	85	50	50	51	55
Twin	30	23	21	21	13
Turboprop	2	5	8	9	15
Jet	0	0	1	2	4
Rotary	12	16	18	20	25
Total	**129**	**93**	**98**	**103**	**113**
T-HANGAR POSITIONS	313	442	459	478	528
SHADE HANGARS (Covered Tiedowns)	116	96	99	102	113
TOTAL HANGAR APRON AREA (SY)	186,410	192,300	199,700	209,700	263,500
CONVENTIONAL	67,994	48,116	50,300	54,300	62,300
SHADE & T-HANGAR	118,416	144,144	149,700	155,400	201,200

AIRCRAFT PARKING APRON

Adequate aircraft parking apron should be provided to accommodate those local aircraft not stored in hangars as well as transient aircraft. At Mesa-Falcon Field apron and tiedown areas are designated for both local and transient aircraft. Local based aircraft are parked in three areas: the Main Apron, adjacent to the Terminal Building containing 203 local (including 170 leased by the City), 134 transient (including 67 City tiedowns); The North Apron located north of Runway 4L-22R, containing 90 local City leased tiedowns; and the South Apron located south of Falcon Drive, containing 48 local City leased tiedowns. The Main and South Aprons have a mix of open tie-downs and hangar facilities.

In addition to these tiedown areas, additional tiedown facilities are located with several conventional hangar leases on the airport with taxiway access. These additional tiedown facilities are considered part of the leased property and are not included in the total airport tiedown figures. However, several tenants located south of Falcon Drive (South Apron area) have indicated a requirement for additional tiedown facilities near their leased areas. This issue will be examined during the examination of development alternatives in the next chapter.

In determining future apron requirements, it is necessary to examine local and transient tiedown facilities as separate entities. The Local apron should at least meet the demand established by the unhangared (and/or uncovered) based aircraft. The number of based aircraft requiring local tiedown facilities was determined and the results depicted in **Table 3E**. There are sufficient local tiedowns at Falcon Field to meet the demand through the 20 year planning period.

Transient parking requirements can be determined from a knowledge of busy-day operations. The number of transient spaces required at Mesa-Falcon Field was determined to be about 35 percent of the busy-day itinerant operations. A planning criterion of 300 square yards (SY) per local based aircraft and 360 SY per transient aircraft was used for the analysis presented in **Table 3E**. The analysis indicates there are sufficient tiedown facilities at Falcon Field to meet the demand throughout the planning period.

TABLE 3E
Forecast Apron Requirements
Mesa-Falcon Field

	Existing	Forecast			
	1990	1995	2000	2005	2015
LOCAL APRON					
Non-hangared general aviation	72	104	107	110	120
LOCAL AIRCRAFT TIEDOWNS	353	104	107	110	120
Apron Area (SY)	105,900	31,200	32,100	33,000	36,000
ITINERANT RAMP					
Busy Day Operations	915	1,147	1,154	1,166	1,198
Busy Day Itinerant Ops	339	379	358	338	419
Busy Day Landings	169	189	179	169	210
ITINERANT PARKING POSITIONS	134	95	95	95	105
Apron Area (SY)	46,900	33,100	33,100	33,100	36,700
TOTAL GENERAL AVIATION APRON	152,800	64,300	65,200	66,100	72,700

TERMINAL BUILDING

General aviation terminal buildings serve several functions. Space is required for administrative and management offices, pilot's lounge and flight planning area, meeting facilities, food services, storage rooms, restrooms and various other needs. This space is not necessarily limited to a single building. In the case of Mesa-Falcon Field, these facilities are currently provided by several FBO's and the restaurants.

The methodology utilized to examine terminal building capacity generally relates square footage requirements for terminal facilities based on the number of design hour general aviation pilots and passengers. Space requirements were determined using 75 square feet per design hour passenger. Table 3F outlines the terminal space requirements for general aviation terminal facilities at Mesa-Falcon Field during the planning period.

As indicated in Table 3F, although it appears the general aviation terminal building would require expansion to meet the demand during the planning period, the existing services and facilities provided by the FBO's and restaurants at the airport will meet the forecast requirements.

TABLE 3F
General Aviation Terminal Building
Mesa-Falcon Field

	Existing	Forecast			
	1990	1995	2000	2005	2015
Design Hour Passengers	54	71	72	73	82
Total Terminal Space (SF)	17,620[1]	3,940	4,000	4,060	4,540

SOURCE: Aviation demand and airport facility requirements forecasts for medium air transportation hubs through 1980, January 1980.
NOTE: [1] Includes 3,800 SF of FBO space, 10,100 SF of restaurant space and 3,720 SF of terminal space.

AUTOMOBILE PARKING

The requirements for public vehicle parking may also be determined as a function of the forecast design hour passengers. The total number of parking positions was projected on the basis of 1.3 spaces per design hour passenger and 315 square feet per automobile parking space. Again, it is important to indicate that parking areas available at the FBO's and other facilities providing pilot/passenger needs are included in determining the available facilities. Table 3G reflects parking facilities that are currently available and those that will be required in the future. Presently, there is sufficient parking to meet the forecast demands.

Automobile parking in the general aviation hangar and tiedown areas is allowed if the vehicle is placed in the same space vacated by the aircraft. Several of the parking areas, which are included in the leases, are unpaved. At some of the conventional hangars, the demand for auto parking is greater than the available space. Auto parking facilities will be required for new facilities. These subjects will be addressed in the next chapter.

TABLE 3G
Public Vehicle Parking Requirements
Mesa-Falcon Field

	Existing	Forecast			
	1990	1995	2000	2005	2015
Design Hour Passengers	54	71	72	73	82
Terminal Vehicle Spaces[1]	190	92	94	95	107
Parking Area (SY)	6,650	3,590	3,640	3,690	4,150

NOTE: [1] **This figure includes the total available public parking at FBO's and others providing service to pilots/passengers at the airport.**

FUEL STORAGE

There is approximately 192,000 gallons of underground fuel storage on the airport, with the tanks placed in several locations (see **Table 1B**). This includes 10,000 gallons of 80/87 Octane, 76,000 gallons of 100 Octane Low Lead and 58,000 gallons of Jet A fuel storage capacity. Additional fuel storage can be made available from fuel dispensing trucks but is not considered permanent storage capacity.

Fuel consumption is directly related to the operational activity at an airport. General aviation fuel storage requirements were determined following analysis of current fuel consumption characteristics at Mesa-Falcon Field. The average consumption the past seven years is approximately 2.8 gallons per operation. The fuel consumption rate has been increasing the past few years to a high of 5.1 in 1989. This relatively high consumption rate is considered somewhat of an anomaly as the rate in 1990 was a more realistic 4.4 gallons per operation. Low fuel consumption rates are indicative of a large amount of single engine aircraft in the fleet mix while the larger aircraft increase the fuel consumption rate.

The forecast fleet mix for Falcon Field has indicated that local training operations will continue to be a high percentage of the operations at the airport until midpoint in the planning period, keeping the fuel consumption rate relatively close to the existing rate. It is anticipated that the consumption rate will increase during the latter half of the planning period. These factors were considered in determining the fuel storage requirements for Falcon Field in **Table 3H**.

Fuel storage capacity was calculated based on a monthly or a two-week fuel supply during the peak month of activity. These requirements are shown in **Table 3H**. The table indicates that fuel storage should be adequate during the planning period. At the forecast rate of consumption, there is capacity to store more than a 30 day supply of fuel. In some cases it may be desirable to provide a minimum 30 day storage capacity in order to lesson the effect of spot shortages or to take advantage of price fluctuations.

TABLE 3H
General Aviation Fuel Storage Requirements
Mesa-Falcon Field

	Existing	Forecast			
	1990	1995	2000	2005	2015
Annual Fuel Sales (gal)	904,653				
Peak Month Fuel Sales (gal)	118,060				
Annual Operations	203,685	294,400	304,800	317,200	349,600
Average Monthly Operations	16,970	24,530	25,400	26,430	29,130
Average Fuel Ratio	4.44	4.45	4.46	4.48	4.50
Mo. Fuel Storage Req. (gal)	118,100	171,000	177,400	185,400	205,300
Bi-Monthly Fuel Req. (gal)	59,100	85,500	88,700	92,700	102,700
Fuel Storage Capacity (gal)	192,000				

AIRPORT ACCESS

Mesa-Falcon Field's location near the proposed Red Mountain Freeway north of the airport and current location in proximity to the Superstition Freeway provides excellent access from a regional perspective. The four major four-lane arterials, one on either side of the airport provide excellent direct access to the airport. On-airport, Falcon Drive is four lane through to the exit on Higley Avenue. All the remaining on-airport streets are two-lane.

The airport may require additional road development in the areas where facility expansion takes place, however, the existing system and future plans for additional arterials and freeways will more than adequately serve the airport in the future.

UTILITIES

The existing water and waste water systems were examined for their capacity to meet the long term demands of the airport. The domestic water supply, which is provided by the City of Mesa, is adequate to meet future demand. The airport presently has two sewage disposal systems, one through the City of Mesa sewer system and the other through a septic tank system. Future plans by the City of Mesa should include the provision of city sewer service to the entire airport and the abandonment of the septic tank system.

SUMMARY

As aviation activity continues to increase at Mesa-Falcon Field, the airport facilities, especially the hangar facilities, will need to be expanded. Most of the major facility needs will be adequate and capable of meeting the forecast demand. In the next chapter, the facilities necessary to meet the future demand will be examined in order to determine the best location and plan for their future development.

Exhibits 3B and 3C illustrate the extent to which the airport facilities should be developed throughout the planning period. The recommended improvements will not only correct existing deficiencies, but also provide the modern and efficient facilities necessary to attract and encourage additional development and services.

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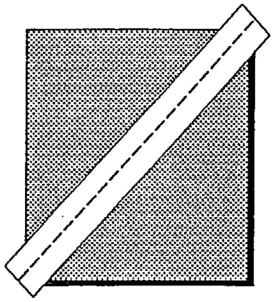
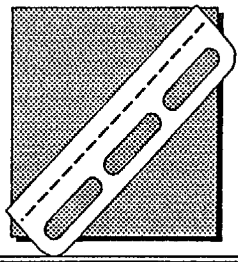
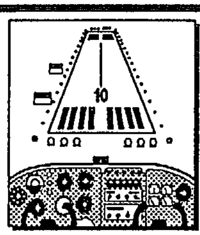
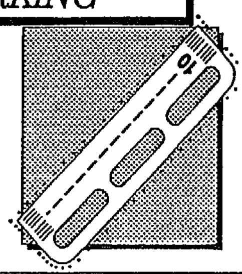
	EXISTING	SHORT TERM	ULTIMATE
RUNWAYS 	Runway 4R-22L 5,100' x 100' 40,000 lbs SWL Runway 4L-22R 3,800' x 75' 12,500 lbs	Runway 4R-22L Same Runway 4L-22R Same	Runway 4R-22L 6,000' x 100'* Runway 4L-22R Same
TAXIWAYS 	Parallel Taxiway "D" 4R-22L 5,050' x 50' Parallel Taxiway "E" 4L-22R 3,800 x 40" Connecting Taxiways 4R-22L = 9 Twys 4L-22R = 5 Twys South Apron = 4 Twys	Parallel Taxiway "D" 4R-22L Same Parallel Taxiway "E" 4L-22R Upgrade to 12,500lbs Connecting Taxiways Add Connecting Taxi Lanes as Necessary	Parallel Taxiway "D" 4R-22L 5,500' x 50' Parallel Taxiway "E" 4L-22R Same Connecting Taxiways Add Connecting Taxi Lanes as Necessary
NAVIGATIONAL and LANDING AIDS 	NDB Rotating Beacon ATCT Segmented Circle Runway 4R-22L PAPI Runway 4L-22R PAPI	NDB- On Airport Runway 4R-22L Same Runway 4L-22R Same	Same Runway 4R-22L Same Runway 4L-22R Same
LIGHTING and MARKING 	Runway 4R-22L MIRL MITL REIL Visual Runway 4L-22R MIRL MITL Visual	Runway 4R-22L Non-Precision Runway 4L-22R Same	Runway 4R-22L Same Runway 4L-22R Same

* A longer runway length will be evaluated

MESA-FALCON FIELD

Exhibit 3B
AIRSIDE FACILITY REQUIREMENTS

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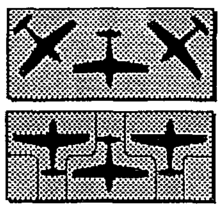
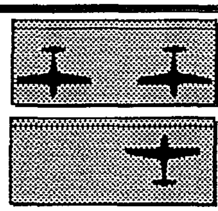
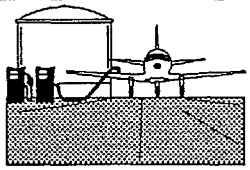
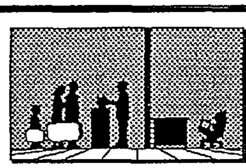
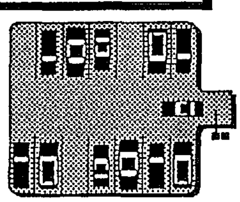
		EXISTING	1995	2005	2015
HANGARS 	Conventional Hangars	18	18	18	18
	T-Hangars	313	442	478	528
	Shade Hangars	116	96	102	113
	Total Hangar Area (Sq. Ft.)	838,845	865,169	943,451	1,185,770
APRON TIE-DOWNS 	Local Apron Positions	353	104	110	120
	Transient Apron Positions	134	95	95	105
	Total Apron Area (Sq. Yd.)	152,800	64,300	66,300	72,700
FUEL STORAGE 	Monthly Fuel Storage (Gal.) Requirements	118,100	171,000	185,400	205,300
	Total Capacity	192,000			
GENERAL AVIATION TERMINAL 	Total Terminal Area (Sq. Ft.)	3,720	3,940*	4,060*	4,540*
AUTO PARKING 	Parking Positions	190	92	95	107
	Total Parking Area (Sq. Yd.)	6,650	3,590	3,690	4,150

* More than adequate general aviation terminal space is made available from FBO's and other services. Approximatley 400 square feet of office space for Airport Management is required in 2000.

MESA-FALCON FIELD

Exhibit 3C
LANDSIDE FACILITY REQUIREMENTS